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INTRA-OSSAL TRANSFUSION OF BLOOD AND MEDICINAL LIQUIDS

Sovetskaya Meditsina, Vol 17, No 9
Moscow, Sep 1953

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In the treatment of anemia produced by a severe hemorrhage, or by a chronic infection, in which the poorly developed subcutaneous veins have collapsed, a blood transfusion frequently becomes impossible. Recently, articles have appeared which describe the transfusion of blood and medicinal liquids into the spongy tissue of bones.

In 1927, Arinkin performed the first intro-ossal puncture to obtain bone marrow. The first intra-ossal blood transfusion was performed by I. A. Kassirskiy in 1942 for the purpose of treating pellagral exsiccosis. He transfused blood into the sternum at the rate of 100 ml per hour.

An experimental check by Yelizarovskiy and Leont'ev showed that liquids injected into the spongy tissue of a bone penetrates into a zone thickly interlaced with veins. Here in the cells of the spongy matter are found the funnel-shaped distended venous capillaries, the so-called sinuses, from which blood flows into the venous system of the organism. In this case both authors make the same interesting observation to the effect that when a dyestuff is introduced into the veins of a cadaver it appears first in the bone marrow, and then in the venous system, leaving the lymphatic channels free of dyestuff.

Clinical tests of the speed of action of substances introduced intra-ossally showed that it was equal to the speed of action of substances introduced intravenously. The speed of action depends primarily on the successful penetration of the needle into the red bone marrow.

Barring any technical mishaps, failure of a bone marrow puncture usually occurs when the needle penetrates the yellow bone marrow. This type of bone marrow is rich in fats but not in capillaries. The sternal method of blood transfusion never gained popularity. This can be attributed to the publication in world literature of articles describing over 20 cases in which there were lethal outcomes caused by injuries to organs of the mediastinum during sternal puncture.

There are numerous other locations in the human skeleton suitable for intro-ossal transfusion. Frayman advocated the internal surface of the upper metaphysis of the tibia. Pytel' proposed to inject blood into the crest of the ilium. Faktorovich proposed the heel bone, and the condyles of the hip. Gromova suggested the seventh and eighth rib. Levantovskiy suggested the external ankle bone, and Verkhvatskiy the pubic bone. Shklyayev, who performed the largest number of intra-ossal blood and blood substitute transfusions (96 cases) into the heel bone, points out the extreme pain caused by this procedure. He notes that the pain is not relieved by novocain injections. A transfusion into the heel bone [calcaneus] has to be performed under pressure, while blood flows into the ilium and tibia by gravity.

The rate of flow (drip method) varies from 12 to 120 drops per minute. Almost all the authors agree on an average figure of 100 ml per hour.

In intra-ossal transfusions, blood substitutes may be used as well as blood.

STAT

The intra-ossal transfusion technique has also been used to administer anesthetics. The indications for intra-ossal anesthesia and the length of time it takes for the patient to fall asleep are the same as for the intravenous method. The duration of the anesthesia varies from 9 minutes to 1 1/2 hours (Ryzhikov).

The intra-ossal method is also used in urography. Leont'yev introduced indigo carmine into the sternum. According to Pytel', methylene blue introduced into the crest of the ilium appears in the bladder in 3-4 minutes.

According to the data of Soviet authors, no complications have been observed during intra-ossal transfusions.

Authors who have worked on the perfection of a method for intra-ossal transfusion are of the opinion that a special needle with an opening on the side of its shaft, and a mandrin precisely adjusted to the diameter of the needle, should be used for this procedure.

Some authors (Kassirskiy, Leont'yev) suggested that a movable shield be put on the needle so that the sternum could be punctured to the exact depth required to reach the spongy matter. Other authors consider the needles of Bier, Record, and Dyuflo [Dufaux ?] as adequate.

In intra-ossal transfusion into the heel bone, the needle is introduced into the lower surface of the bone, within the area of its middle third (Shklyayev). In a puncture of the tibia, the needle should be introduced along the internal surface of the upper metaphysis, where sections of the bone marrow are most accessible. In a puncture of the ilium the needle is introduced 2 cm from the crest down and towards the back of the bone.

In all cases of intra-ossal transfusion the epidermis, the subcutaneous cellular tissues, and the periosteum should be locally anesthetized by a solution of novocain, prior to the puncture.

We administered a total of 52 intra-ossal transfusions to 25 patients. The indications for this procedure were in all cases: a collapse of subcutaneous veins caused by a prolonged severe infection, the exhaustion of a patient due to cicatricial contraction of the esophagus, or burns on the extremities.

Donor's blood, erythrocyte suspension, animal blood, and species non-specific serum were used in the transfusions. Glucose and penicillin were used in 12 cases. The amount of transfused liquid varied from 100 to 1,200 ml. One hundred milliliters were transfused in cases where the transfusion subsequently had to be discontinued owing to a lack of success [in carrying it out] or to the slow penetration of infrequent drops of blood.

Transfusions were made into various bones. In all cases the procedure was performed under local novocain anesthesia.

The needle proposed by Leont'yev was used at first. Later, standard Dyuflo needles, the tip of which had been filed off, and a precisely adjusted mandrin were used. The transfusions were performed by means of two and sometimes four needles.

Five transfusions were made into the sternum, 15 into the ilium, 20 into the metaphysis of the tibia, and nine into the heel bone. The minimum drip rate was 40 drops per minute, and the maximum 120-160 drops per minute.

Transfusions into the heel bone were discontinued since the method was found to be too painful.

STAT

There were no complications due to intra-ossal transfusions.

Failure was observed in only three cases when acutely ill patients were admitted to the institute too late, and died as a result of exhaustion caused by cicatricial obstructions of the esophagus.

Histological examinations of the bones in these cases (Prof A. V. Rysakov) revealed marked changes in the structure of the spongy matter of the bones. These changes probably occurred as a result of severe and prolonged illness, and prevented the entrance of blood and liquids into the blood stream.

Conclusions

1. The intra-ossal transfusion of blood and medicinal liquids can be recommended as one method of assisting a patient suffering from a severe hemorrhage, from anemia due to a prolonged purulent infection, or from extensive burns on the extremities.
2. An intra-ossal transfusion is a simple procedure, easily performed by any practicing physician regardless of his particular field of specialization.
3. Punctures of the sternum are not recommended in the beginning. In order to acquire the feeling of "striking" the spongy tissue of the bone, punctures of the ilium or the tibia should be made using standard method. A transfusion into the heel bones is to be avoided because of the pain inflicted on the patient.
4. In order to insure the complete success of an intra-ossal transfusion, the needles used should be appropriate. The end of the needle should be ground at an angle no greater than 60-70°. The mandrin should fit exactly.

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